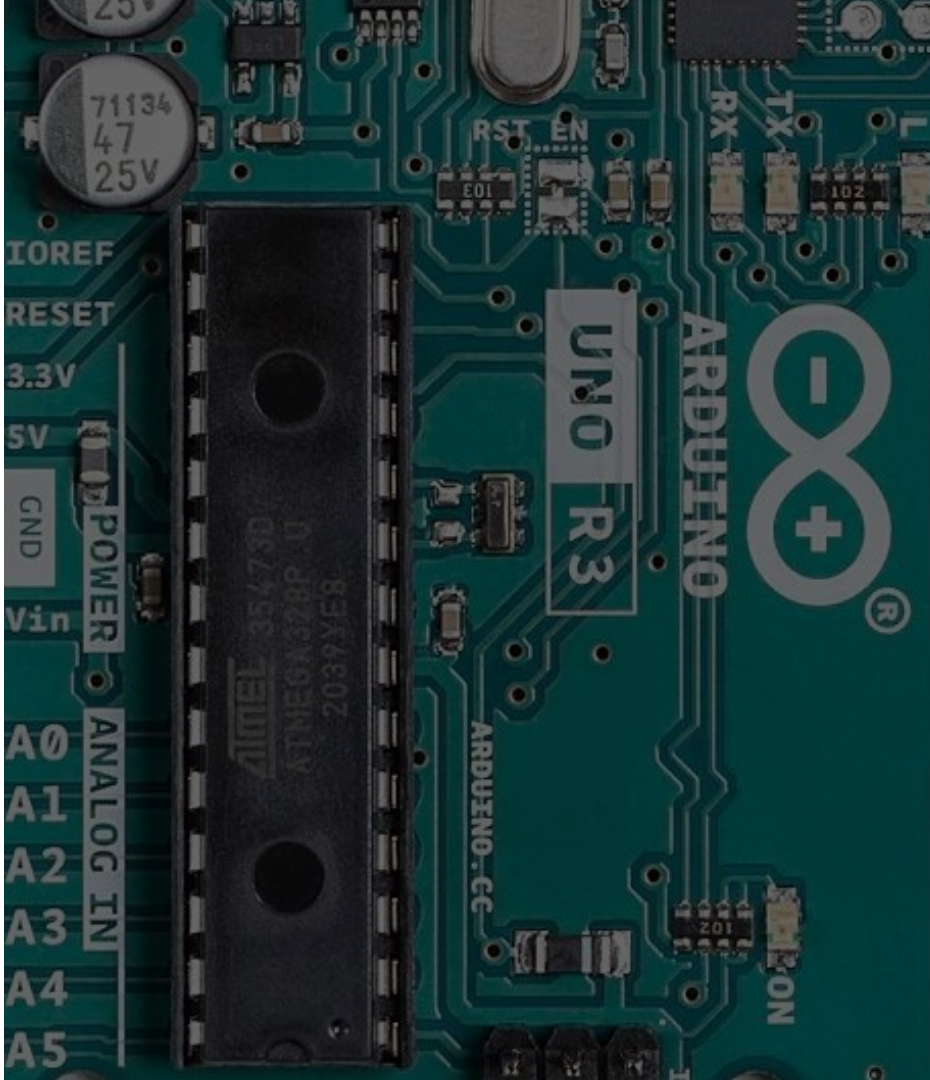
TinyGo
Going small on microcontroller and WebAssembly

Bjoern Poetzschke

Agenda

- What is TinyGo?
- How small?
- How tiny?
- How is it achieved?
- How to get started?
- Examples
  - WebAssembly (3)
  - Arduino Nano 33 IoT (6)
- Links



What is TinyGo?

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It’s a compiler for small places.

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What is TinyGo?

- OpenSource

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What is TinyGo?

- OpenSource
- The code is available on GitHub
- 12k + Stars
- ~ 700 Forks
- 138 Contributors

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Most of Go language supported

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Supported Go language features

- All basic types and control flows supported (incl. `switch`)
- Goroutines
- Generics
- Defer
- Slices
- Interfaces work in most of the cases
- Go modules
- File embedding
- Overview: https://tinygo.org/docs/reference/lang-support/stdlib/

How small?

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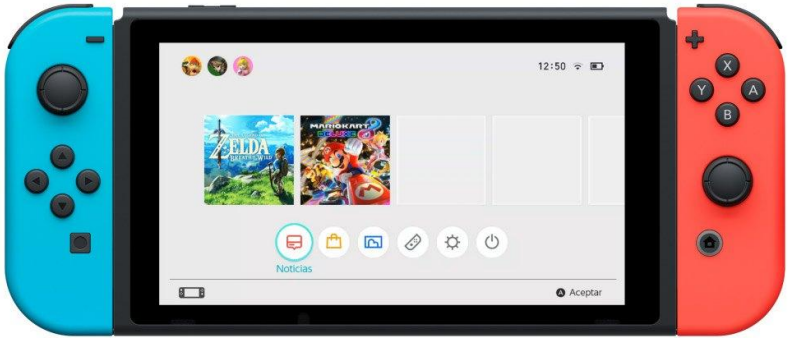
How small?



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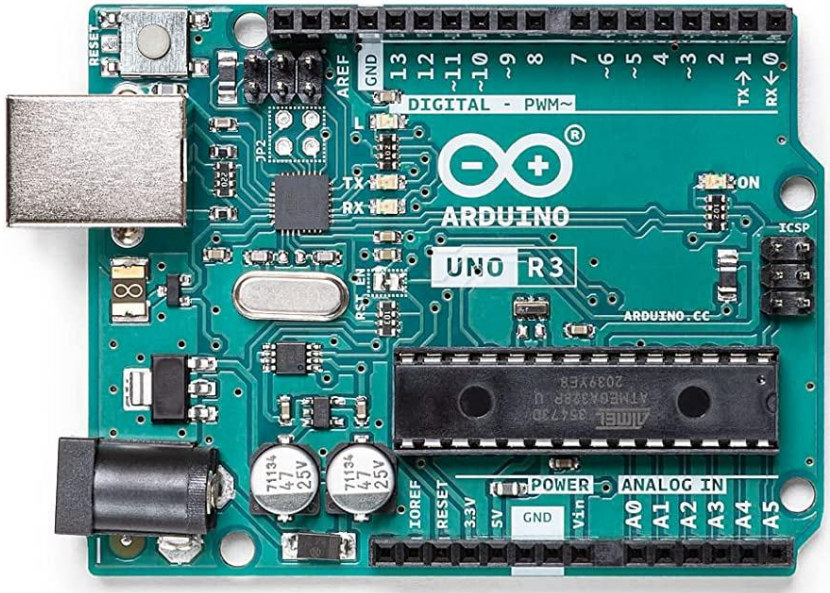

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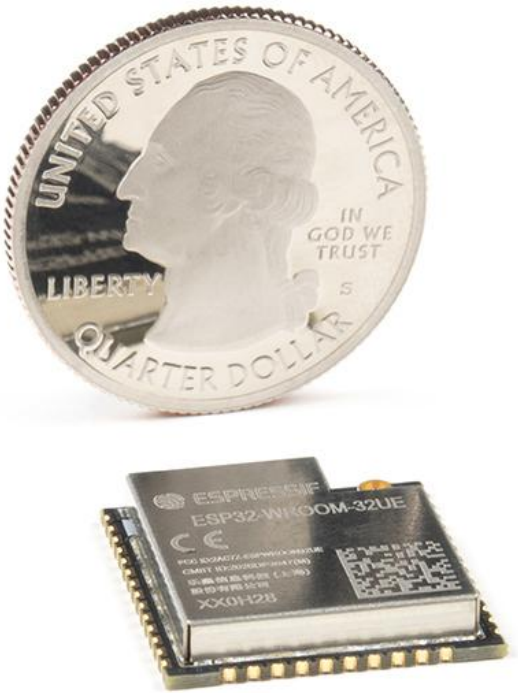

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- New type of code runnable in modern browsers
- Assembly like
- Near native performance
- Compilation target for different languages
- Can run alongside JS

Support for 86 microcontroller

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Drivers for 90 sensors & displays

https://github.com/tinygo-org/drivers

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Plugins for VS Code, Goland.

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Playground available
play.tinygo.org

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How tiny?

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How tiny?

```
package main


import "fmt"


func main() {
    fmt.Println("Hello World")
}
```

How tiny?

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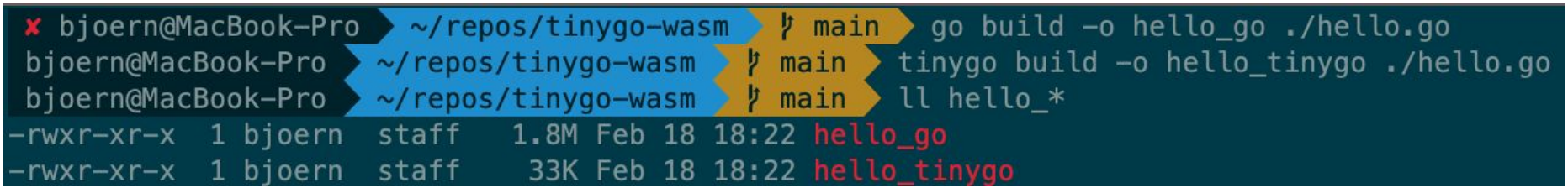
How tiny?



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How tiny?

```
 bjoern@MacBook-Pro  ~/repos/tinygo-wasm  main  GOOS=js GOARCH=wasm go build -o wasm ./hello.go
 bjoern@MacBook-Pro  ~/repos/tinygo-wasm  main  tinygo build -o wasm_tinygo -target wasm ./hello.go
 bjoern@MacBook-Pro  ~/repos/tinygo-wasm  main  ll wasm*
-rwxr-xr-x  1 bjoern  staff   2.0M Feb 22 10:40 wasm
-rwxr-xr-x  1 bjoern  staff   179K Feb 22 10:40 wasm_tinygo
```

How is it achieved?

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https://tinygo.org/docs/concepts/compiler-internals/pipeline/

How to get started?

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How to get started?

Installation

- Install TinyGo
  - Docker
  - Linux
  - Mac (Homebrew available)
  - Windows
- Depending on your microcontroller additional tools required
  - Arduino requires Bossa on Mac
- Follow instructions at: https://tinygo.org/getting-started/install/

How to get started?

Run a program

- `tinygo flash -target=arduino-nano33 blinky.go`
  - Compiles the program
  - Writes it onto the microcontroller
  - Runs the program

How to get started?

Debugging

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How to get started?

Debugging

- Logs!
- Logs are written to the serial console
- For most of the microcontrollers the serial console is available via the connected USB port
- Multiple ways to read the output
  - Read serial console manually

    ```
    ls -al /dev/cu.*
    ```

    ```
    screen /dev/cu.usbmodem14313201 9600
    ```
  - Use Arduino IDE, etc.
- More information about serial communication can be found **here**.

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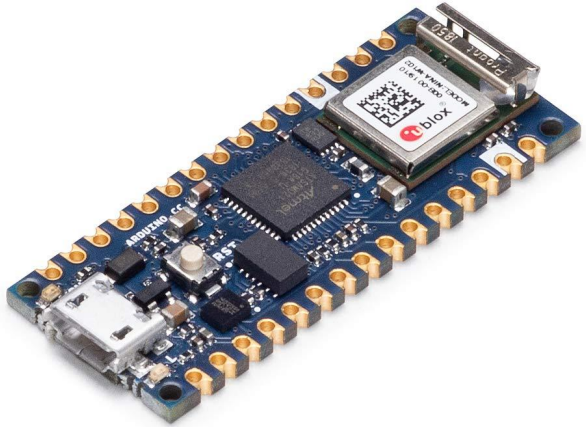
Web Assembly examples

- Simple add method w/ calculation being done in TinyGo
- Add method with complete setup in TinyGo
- Advanced example with HTML Canvas elements

Arduino examples



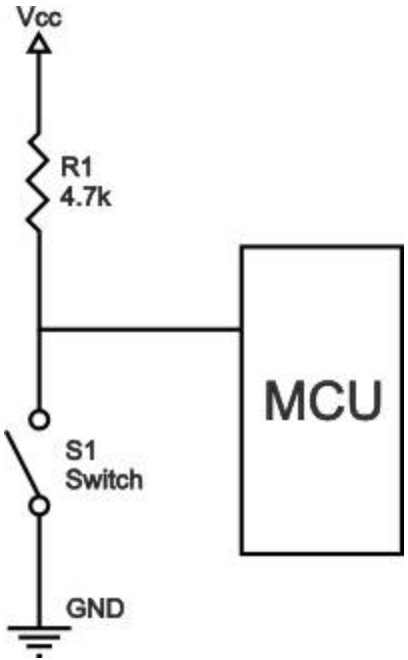
- Hello World / Blinky
- Led w/ Button
- Goroutines
- Connect a Temperature & Moisture sensor
- Temperature & Moisture sensor + push to RESTful API

Floating pins

- 0 state is called low and 1 state is called high
- Microcontroller only knows if a pin is high if the input voltage is above a certain threshold.
- If pin is left open then stray RF can bring the pin above the threshold to cause a high reading.
- To solve this problem use pullup or pulldown resistors.

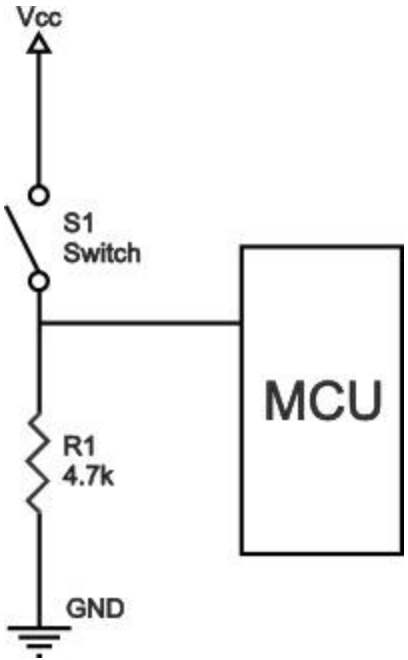
Floating pins

Pull up



Floating pins

Pull down



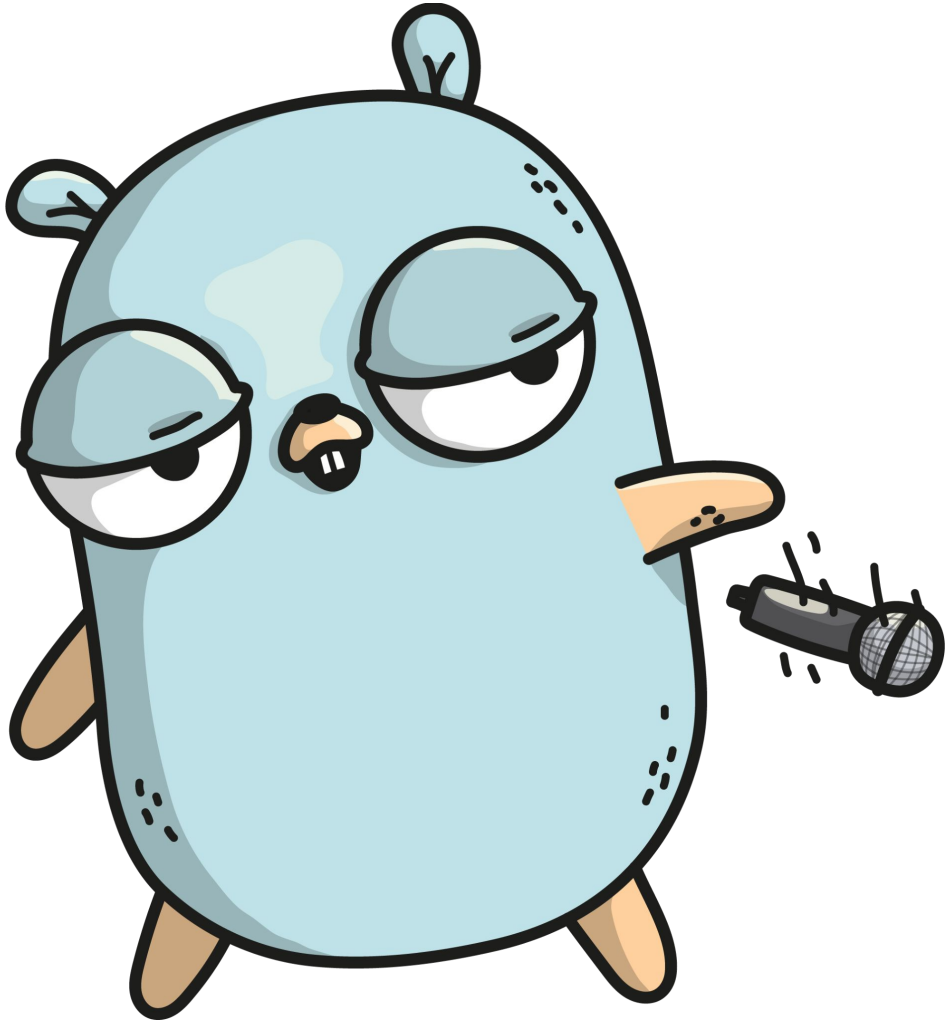
Floating pins

- TinyGo supports toggling Pullup and Pulldown from microcontroller

- `input.Configure(machine.PinConfig{Mode: machine.PinInputPullup})`

Examples

- https://github.com/bpoetzschke/tinygo-examples
- https://github.com/bpoetzschke/tinygo-wasm



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Links

- https://www.thushanfernando.com/posts/2020/tinygo-big-things/
- https://www.youtube.com/watch?v=M4XyxXsQbK8
- https://www.youtube.com/watch?v=D46NzhBoQC0
- https://www.youtube.com/watch?v=EiB9ZVrvrz0
- https://www.tinygo.org
- https://tinygo.org/docs/guides/webassembly/
- https://tinygo.org/docs/concepts/compiler-internals/pipeline/
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